duty universally, or the contrary. But this is to misapprehend the real question, which is rather, whether there is any race of men among whom nothing is considered a duty. Is there any race with whom there are not certain acts which the majority do, or refrain from doing, independently of any fear of punishment, but because they believe them to be right or wrong? And is there, on the other hand, any race of animals whose actions are influenced in the same way? We think the answer to these questions would show a positive distinction between man and the lower animals, which distinction would hardly be lessened by maintaining that the idea of duty so defined is in savages only the fear of punishment by gods or demons, since it will not be maintained that the lower animals are ever influenced by such motives.

Passing over a curious chapter on the utilisation of the lower animals, chiefly by educating and making slaves of the anthropoid apes, we come to the subject of language, which is discussed in a manner which exhibits the author's defects and merits in a remarkable degree. He thinks it necessary to approach the subject by a discussion on the fables of speaking stones and plants, of the sounds emitted by nudibranch molluscs and fish, the hissing of serpents, and the croaking of toads. By interpreting the notes of certain birds into words, such as "Whip-poor-will," and a number of others, he arrives at the conclusion that some savage languages have fewer letter-sounds than have those of certain animals. The physiology of voice and the construction of speaking automatons is next sketched, before we come to the really valuable part of the chapter, in which the variety of sounds and calls of several species of animals are detailed, and it is thus shown that they possess a language of no contemptible extent. He also maintains that animals understand, or rather learn to understand, the language of very distinct species. His dogs, for instance, perfectly understood his poultry. Cocks and hens have one danger signal for the approach of a bird of prey, another for that of a terrestrial animal or for man. The latter would rouse the sleeping dogs, who would instantly rush out and bark, while they took no notice whatever of the former. This proves that fowls have a language capable of expressing slightly different but closely connected ideas, and also that dogs soon learn the languages of other animals.

The subject of Hereditary Transmission is very imperfectly treated. M. Houzeau is evidently unacquainted with Mr. Galton's researches, or he would not have arrived at the conclusion that "a more or less complete transmission of the physical type with independence more or less absolute of the intellectual and moral type,—such is the law of observation, the law of nature."

In his last lecture on "Sociability" the doctrine is boldly advocated that of all animals Ants approach nearest to man in their social condition. They represent semi-civilised societies; while the highest Apes only represent the lowest savage state. The varied modes of association among the lower animals and in the human race are detailed with great fulness, but with little influence on the general argument. On the question of the affiliation of races, we find some good remarks on the comparative value of the useful arts, the food plants and domesticated animals, as compared with customs and superstitions. The evidence afforded by the latter is, he maintains, absolutely valueless unless supported by the former. In the concluding paragraphs of the work are some expressions and arguments which seem to show that the author is not an evolutionist, and has no clear ideas as to whether new species of animals are now coming into existence or not, or as to whether man has or has not originated from a lower animal form. This leads to an ambiguity and inconclusiveness in the whole work which contrasts strongly with the clear and definite views of such men as Darwin and Spencer, whose works lead us on by many and varied lines of research till they converge towards a grand and impressive conclusion. The present work cannot for a moment be compared with such as these; but it has special merits of its own, and it contains a mass of curious facts, acute observations, and sound reasoning, which fully entitle its author to take high rank among philosophical naturalists.

ALFRED R. WALLACE

GANOT'S NATURAL PHILOSOPHY

Popular Natural Philosophy. By Ganot. Translated by E. Atkinson, Ph.D. (Longmans and Co.)

THIS is a good elementary book, giving the first principles of the subjects with which it deals in a clear and concise manner, with very few unnecessary words. The work is not an abridgment of Ganot's "Elements of Physics," but is founded on Ganot's "Cours Elémentaire de Physique," of which it is not a mere translation; but additions and alterations have been made by Dr. Atkinson, with the view of rendering it more fit to serve the purpose for which it is designed, namely, to act as a "text-book of physics for the middle and upper classes of boys' and girls' schools, and as a familiar account of physical phenomena and laws for the general reader." The book is very well adapted for these purposes. It is entirely free of mathematical formulæ, which, though but sparsely used in Ganot's "Physics," are still an insuperable barrier to the use of some portions of that work by the non-mathematical reader. The subjects treated of are the same as those in Ganot's "Physics," namely—the properties of matter, hydrostatics, pneumatics, acoustics, heat, light, magnetism, and electricity. The treatment of these subjects is, however, not only more elementary but somewhat less comprehensive than in the larger book. The engravings of the instruments and of the experiments detailed are good and suggestive, and calculated to be of assistance not only to the learner but to the teacher. There is, however, a good deal of what is superfluous in a considerable number of the illustrations, and a few of the illustrations themselves are unnecessary. It is, perhaps, over-refinement of criticism to object to the superfluity of embellishment in Fig. 140, in illustration of a speaking tube. (By the way, how exceedingly small the fire is!) Fig. 139 seems quite unnecessary in explaining the experimental determination of the velocity of sound by the Bureau of Longitude of Paris.

Although, however, there may be a good deal of what is superfluous in the illustrations, there is nothing which is misleading; but, on the contrary, they are in all cases calculated to leave a correct impression of the point in question on the mind of the reader. Fig. 349, however,

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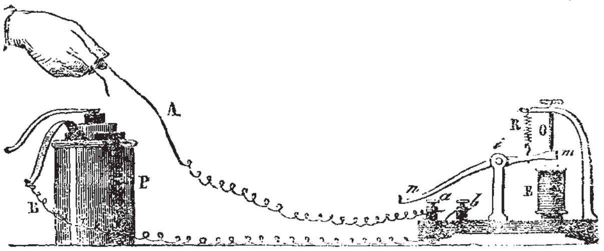
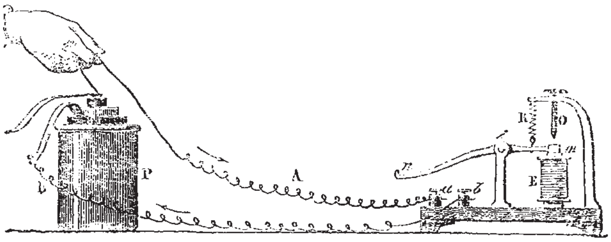
of the aurora borealis hardly deserves such a favourable criticism.

As usual with almost all treatises on Natural Philosophy, we have to find fault with the character of the very few remarks which are devoted to terrestrial magnetism; but we know of no elementary book which deals with that very interesting subject sufficiently, and of hardly any which deal with it correctly.



The explanation of the principle of the telegraph is very lucid, and the diagrams connected therewith are exceedingly well adapted for enabling the learner to grasp the principle. The accompanying pair of diagrams in illustration of the principle of Morse's Telegraph leave hardly any verbal explanation necessary.



Diagrams of a self-explanatory character, and which, to a certain extent, stand in place of words, form a very useful feature in an educational text-book.

JAS. STUART

OUR BOOK SHELF

Jahrbuch der kaiserlich-königlichen geologischen Reichsanstalt. No. 1, 1872. Band xxii. (Wien.)

THIS part of the Year-book contains three papers devoted to the mining industries of Austria. In one of these—"On the Future of Mining in Austria," by Constantin Freih. v. Beust, we have concise and interesting sketches of the several mineral-bearing regions of Bohemia and Moravia, as also of the various rock formations of the Alpine districts which are metalliferous. The author comes to the conclusion that mining in Austria is capable of vast development, there being goodly stores of silver, lead, zinc, iron pyrites, and even perhaps of gold, which only require energy and enterprise to win them. The same writer contributes a second paper, "On the Direction of the principal Veins in the non-Hungarian Lands of the Austro-Hungarian Monarchy." Franz Ritter v. Hauer also gives some account of the ironstones worked by the Styrian Iron Company near Eisenerz. Dr. Emil Tietze has a long and able memoir on the geology and palæontology of the southern regions of the Banat mountains (Hungary). The descriptions of cretaceous and liassic fossils, many of which are of species new to science, and the illustrative plates that accompany the memoir, are well worthy the attention of palæontologists. In the *Mineralogische Mittheilungen*, edited by Prof. Tschermak, we have, amongst a number of other papers, one by Prof. Inostranzeff of Petersburg, giving the results of his examination of certain limestones and dolomites as bearing on questions of metamorphism. Prof. A. Exner, of Vienna, also contributes a "Chemical Examination of the Meteorites of Gopelpur." Other papers by M. Websky, A. Brezina, and F. Babanek, on mineralogical subjects, will serve to sustain the reputation acquired by our German friends in a department of science which has far too few votaries in this country.

The Metric System of Weights and Measures: an Address delivered before the Convocation of the University of the State of New York, at Albany, August 1, 1871. By Frederick A. P. Barnard, S.T.D., LL.D., President of Columbia College, New York City, &c. (New York, 1872.)

PRINCIPAL BARNARD was appointed, in 1871, by the Trustees of the University of the State of New York to attend a meeting of the Convocation of that University, who were adverse to the introduction of the Metric System, and to enlighten them as to its real nature, and the immense advantages that would flow from its adoption. He seems to have performed his duty with great ability, and we hope with equal success. This volume contains a revised edition of that address, with considerable additions in the form of notes and appendices. Principal Barnard gives a very lucid account of the origin and nature of the metric system, narrating the recent progress of meteorological reform, and answering with what appears to us unassailable arguments the objections commonly urged to its universal introduction into all civilised communities. One appendix contains a long, interesting and useful dissertation on the Unification of Moneys, with some well-arranged information on what has already been prepared and done. In another appendix he describes and discusses the various experiments which have been made to fix on a standard for measures of capacity. His third appendix is on the legislation of Great Britain and of British India in regard to the metric system; and his last appendix contains some very interesting, and what many will deem astonishing, statistics on the extent to which the system has been already adopted. From this we learn that France, Spain, Holland, Belgium (and their colonies), Portugal, Italy, the North German Confederation, Greece, Roumania, British India, and nearly the whole of the countries of Central and South America, have adopted the metric system in full; they represent a population of 336,419,595. Wurtemburg, Bavaria, Baden, Hesse, Switzerland, Denmark, Austria, and Turkey, representing a population of 84,039,209, have adopted metric values; while in Great Britain and the United States, containing a population of 70,373,091, the system is still permissive. In Sweden and Norway (population in 1867 5,897,159) the decimal division has been adopted without the metric values. Thus the peoples already decidedly enlisted on the side of the system include a total population of about 420,000,000. This looks hopeful, and there seems no doubt that this rational system of weights and measures will ere long be universally adopted. One very remarkable fact the author mentions in confirmation of this. At the close of last century, the simple measure of length called the foot had not less than *sixty* different values—probably many more—actually in use in different parts of Europe; in 1867, there could be found only *eight* of this discordant class surviving. We would recommend Dr. Barnard's book to all who wish to possess a clear and intelligible account of the system and its many advantages within a moderate compass.

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